

REMARKS

The Examiner's recognition of Applicants' invention by the allowance of claims 2, 4-12, and 24 is gratefully acknowledged.

Rejection of Claim 13 et al. based on Kaminaga et al, Pedder and Matayabas et al.

Claims 13 and 16-20 were rejected under 35 U.S.C. § 103 as unpatentable over United States Patent No. 6,257,215, issued to Kaminaga et al. in 2001, in view of United States Patent No. 6,005,466, issued to Pedder in 1999, and further in view of United States Patent Application Publication No. 2004/0191503, by Matayabas et al.

In accordance with Applicants' invention as set forth in claim 13, a thermoplastic composite is used to encapsulate a semi-conductor chip that is mounted to a substrate by what is commonly referred to as a flip chip process. In a flip chip process, the chip is spaced apart from the substrate by a gap in which solder interconnections are located. In common flip chip processes, the chip is not overmolded, and the gap between the chip and the substrate is filled with an underfill material that is a thermoset resin and is formulated as a liquid that readily flows into the gap and reacts to form the product. Applicants have discovered that, in an overmolding process, a thermoplastic resin is also suitable for an underfill, see paragraph 10. Thermoplastic resin tend to be tougher and less brittle than thermoset resins, and so improve shock and impact resistance, paragraphs 10 and 20. The references do not lead the practitioner to use a thermoplastic material in

an overmolding process that includes underfilling a chip, and so do not point to Applicants' invention in claim 13.

Kaminaga et al. describes an electrical assembly that includes electronic devices embedded in a transfer-molded epoxy package 7, col. 6, beginning at line 3. As acknowledged in the Office Action, Kaminaga et al. does not disclose a thermoplastic resin for the overmold/underfill body.

Pedder is applied to show a semiconductor chip mounted to a substrate using solder bumps having diameters between 50 and 125 micrometers. However, Pedder does not describe an underfill or overmold material, and so cannot suggest a thermoplastic material that accomplishes both.

The rejection points to Matayabas et al. to show a thermoplastic material. Referring to Fig. 1, Matayabas et al. describes a thermal interface material is applied at a joint 104 between a semiconductor device 103 and a heat spreader 105, paragraph 0028, or at joint 108 between heat spreader 105 and heat sink 106, paragraph 0030. The material is applied as a thin layer during assembly of the elements in order to promote heat transfer in the final product. Matayabas et al. does not disclose that the material that is formulated to be applied as a layer in forming the joints is suitable for a molding to encapsulate a delicate component, such as a semi-conductor chip. More significantly, Matayabas et al. discloses and depicts a device 103 that is a flip chip and so includes a gap between semiconductor device 103 and substrate 101. However, Matayabas et al.

does not disclose use of the joint material to fill the gap under the chip. Rather, Matayabas et al. explicitly teaches that the gap may be filled by a conventional epoxy material, paragraph 0027. Thus, Matayabas et al. does not lead the practitioner to use the joint material disclosed therein as an underfill in an overmolding process.

Therefore, the combination of these references does not point to Applicants' invention in claim 13. Claim 13 is directed to Applicants' overmolded electrical component that includes a semi-conductor chip spaced apart from a substrate, and a polymeric overmolding that encapsulates the chip and fills the space between the chip and the substrate. The claim further recites that the overmolding is formed of a polymeric composite that includes a thermoplastic resin matrix. Kaminaga et al. discloses an underfill material that is formed of a thermoset, particularly an epoxy. Pedder is silent as to a composition for an underfill. Matayabas et al., like Kaminaga et al., discloses an epoxy underfill. None of the references show an underfill that is a thermoplastic resin. With regard to the thermoplastic material disclosed by Matayabas et al., the practitioner would not ignore that express teachings of Matayabas et al. to use epoxy, and conclude, as obvious, that the materials formulated by Matayabas et al. to be applied as a coating are suitable for molding or would flow into a thin gap – 10 to 150 micrometers – to form an underfill. Thus, the references do not lead the practitioner to Applicants' overmolded electrical component in claim 13.

Claims 16-20 are dependent upon claim 13 and so not taught or suggested by the references at least for the reasons set forth with regard to that claim.

Accordingly, it is respectfully requested that the rejection of claims 13 and 16-20 based upon Kaminaga et al., Pedder and Matayabas et al. be reconsidered and withdrawn, and that the claims be allowed.

Rejection of Claims 21-22 based on Kaminaga et al, Pedder, Matayabas et al. and Yu et al.

Claims 21-22 were rejected under 35 U.S.C. § 103 as unpatentable over United Kaminaga et al., Pedder, and Matayabas et al. in view of United States Patent No. 5,153,657, issued to Yu et al.

Claims 21-22 are dependent upon claim 13. For the reasons above, Kaminaga et al., Pedder, and Matayabas et al. do not teach or suggest Applicants' overmolded electrical component in claim 13 that includes a thermoplastic overmolding. It follows, then, that the references do not show the invention in claims 21 and 22 that incorporate these features.

Yu et al. is cited to show glass spheres as a filler. However, Yu et al. is directed to a cleaning blade. Yu et al. does not contemplate a material that is suitable for underfilling and overmolding a flip chip. Moreover, whereas the primary references show an epoxy compound for underfilling, Yu et al. does not lead the practitioner to utilize a thermoplastic material for this purpose. Thus, even when combined with Yu et al., the references do not suggest Applicants' overmolded component in claim 13, or in

claims 22 and 22 dependent thereon.

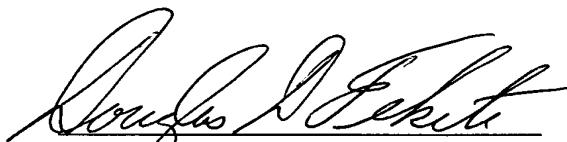
Accordingly, it is respectfully requested that the rejection of claims 13 and 16-20 based upon Kaminaga et al., Pedder, Matayabas et al. and Yu et al. be reconsidered and withdrawn, and that the claims be allowed.

Conclusion

It is believed, in view of the remarks herein, that all grounds of rejection of the claims have been addressed and overcome, and that all claims are in condition for allowance. If it would further prosecution of the application, the Examiner is urged to contact the undersigned at the phone number provided.

The Commissioner is hereby authorized to charge any fees associated with this communication to Deposit Account No. 50-0831.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Douglas D. Fekete", written over a horizontal line.

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